

CLAIMS

1. A control system for a hybrid vehicle, in which a second prime mover (5) is connected to an output member (2) to which a power is transmitted from a first prime mover (1) through a transmission (6) in which a torque capacity is varied in accordance with an oil pressure, and which has a first hydraulic pump (32) driven by the first prime mover (1) for establishing an oil pressure to be fed to the transmission (6), and a second hydraulic pump (33) arranged in parallel with the first hydraulic pump (32) and driven by an electric motor (33M), characterized by comprising:

a torque limiting means (30) for limiting an output torque of the second prime mover (5) temporarily, at a starting time of the first prime mover (1).

15 2. The control system for a hybrid vehicle according to Claim 1, characterized by further comprising:

a hydraulic pump driving means (31) for driving the second hydraulic pump (33) when the first prime mover (1) is halted.

20 3. The control system for a hybrid vehicle according to Claim 2, wherein the first prime mover (1) includes an internal combustion engine (10) which is started by carrying out a motoring by an external force, and

25 characterized by further comprising a hydraulic pump halting means (31) for halting the second hydraulic pump (33) after a complete

combustion in the internal combustion engine (10) is determined.

4. The control system for a hybrid vehicle according to Claim 3,

wherein the first prime mover (1) further comprises another motor

5 (11) for carrying out the motoring of the internal combustion engine (10),
and

wherein the hydraulic pump halting means (31) includes a means
for halting the second hydraulic pump (33), after a complete combustion in
the internal combustion engine (10) is determined on the basis of changes in
10 the speed and the current value of said another motor (11).

5. The control system for a hybrid vehicle according to any of Claims 1
to 3, characterized by further comprising:

a halt control means (13) for halting the first prime mover (1)

15 subsequent to driving of the second hydraulic pump (33), in case of halting
the first prime mover (1) when the transmission (6) is set to the
predetermined torque capacity by the oil pressure fed from the first
hydraulic pump (32).

20 6. The control system for a hybrid vehicle according to Claim 5,
characterized by further comprising:

a means (13, 16, 30) for carrying out a control for running a vehicle
by the second prime mover (5), after a control for halting the first prime
mover (1) is carried out.

7. The control system for a hybrid vehicle according to Claim 5, characterized by further comprising:

a means (31) for determining a drive of the second hydraulic pump (33) on the basis of a speed and a current value of the electric motor (33M).

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8. The control system for a hybrid vehicle according to any of Claims 1 to 4, characterized by further comprising:

a speed determining means (13, 31) for determining that the speed of the first prime mover (1) is lowered to a preset reference level when the 10 vehicle is run by the second prime mover (5) instead of the first prime mover (1), and

a starting means (31) for starting the second hydraulic pump (33) in case the speed determining means (13, 31) determines that the speed of the first prime mover (1) has been lowered to a preset reference level.

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9. The control system for a hybrid vehicle according to any of Claims 1 to 4, characterized by further comprising:

a hydraulic pump drive determining means (31) for determining a change in the driving state of the first hydraulic pump (32) resulting from 20 shifting of the first prime mover (1) from the halting state to the driving state, on the basis of the operating state of the second hydraulic pump (33).

10. The control system for a hybrid vehicle according to Claim 9, characterized in that:

25 a hydraulic pump drive determining means (31) includes a means

for determining a change in the driving state of the first hydraulic pump (32) on the basis of a drop in a back electromotive force or rise in a current value of the motor (33M).

5 11. The control system for a hybrid vehicle according to any of Claims 1 to 4, 6 and 7, characterized by further comprising:

10 a line pressure control means (31) for switching a line pressure or an initial pressure of the oil pressure to be fed to the transmission (6), from a predetermined low pressure to a higher pressure than that at the startup time of the first prime mover (1) while the second hydraulic pump (33) is generating the oil pressure, and for bringing the line pressure from the high pressure back to the low pressure after a completion of the startup of the first prime mover (1).

15 12. The control system for a hybrid vehicle according to any of Claims 1 to 4, 6 and 7, characterized by further comprising:

20 a means (30) for lifting a limitation of an output torque of the second prime mover (5) on the basis of the fact that the first prime mover (1) is started and an oil pressure established by the first hydraulic pump (32) has been raised sufficiently.

13. The control system for a hybrid vehicle according to Claim 1, characterized by further comprising:

25 a load accumulating means (31) for accumulating a load depending on a line pressure of the transmission (6) fed by the second hydraulic pump

(33) and the oil temperature for every preset time, and for subtracting preset value from a cumulative value of the load in case the second hydraulic pump is halted (33); and

5 a drive control means (13, 31) for inhibiting a halt of the first prime mover (1) in case the cumulative value of the load exceeds a preset value, and for allowing the halt of the first prime mover (1) in case the cumulative value of the load becomes small than an another preset value.

14. A control system for a hybrid vehicle, in which a second prime mover 10 (5) is connected to an output member (2) to which a power is transmitted from a first prime mover (1) through a transmission (6) in which a torque capacity is varied in accordance with an oil pressure, and which has a first hydraulic pump (32) driven by the first prime mover (1) for establishing an oil pressure to be fed to the transmission (6), and a second hydraulic pump 15 (33) arranged in parallel with the first hydraulic pump (32) and driven by an electric motor (33M), characterized by comprising:

a load accumulating mean (31) for accumulating a load depending on a line pressure of the transmission (6) fed by the second hydraulic pump (33) and the oil temperature for every preset time, and for subtracting 20 preset value from a cumulative value of the load in case the second hydraulic pump is halted (33); and

25 a drive control means (13, 31) for inhibiting a halt of the first prime mover (1) in case the cumulative value of the load exceeds a preset value, and for allowing the halt of the first prime mover (1) in case the cumulative value of the load becomes small than an another preset value.

15. The control system for a hybrid vehicle according to Claim 1, characterized in that the first prime mover (1) comprises:

an internal combustion engine (10),

5 a motor generator (11), and

a gear mechanism (12) for performing a differential action to distribute an output torque of the internal combustion engine (10) to the motor generator (11) and the output member (2).

10 16. The control system for a hybrid vehicle according to Claim 15, characterized in that:

the gear mechanism (12) includes a planetary gear mechanism, comprising;

an input element (19) to which the torque of the internal combustion engine (10) is inputted,

15 a reaction element (17) to which the motor generator (11) is connected, and

an output element (18) to which the output member (2) is connected.

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17. The control system for a hybrid vehicle according to Claim 15, characterized in that:

the gear mechanism (12) includes a single pinion type planetary gear mechanism, comprising;

25 a carrier (19) to which the torque of the internal combustion

engine (10) is inputted,

a sun gear (17) to which the motor generator (11) is connected, and

a ring gear (18) to which the output member (2) is connected.

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18. The control system for a hybrid vehicle according to Claim 1, characterized in that:

the transmission (6) includes a mechanism capable of interchanging a gear ratio between at least high and low.

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19. The control system for a hybrid vehicle according to Claim 18, characterized in that:

the mechanism includes a Ravigneaux type planetary gear mechanism.

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20. The control system for a hybrid vehicle according to Claim 1, characterized in that the transmission (6) comprises:

a first sun gear (21) which is fixed selectively;

a ring gear (25) which is arranged concentrically with the first sun

20 gear (21);

a first pinion gear (23), which meshes with the first sun gear (21);

a second pinion gear (24) which meshes the first pinion gear (23) and the ring gear (25);

a carrier (26) which holds those pinion gears (23, 24) and which is

25 connected to the output member (2); and

a second sun gear (22) which meshes with the second pinion gear (24), and to which the second prime mover (5) is connected.

21. The control system for a hybrid vehicle according to any of Claims 1
5 to 13 and 15 to 20, characterized in that:

said torque limiting means (30) includes a means for limiting the output torque of the second prime mover (5) temporally to a predetermined torque which is lower than a maximum output torque.